International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(4): 1485-1491

Received: 25-05-2019
Accepted: 27-06-2019

R Beena
Department of Biochemistry, Kongunadu Arts and Science College, Coimbatore, Tamil Nadu, India

V Selvi
Department of Biochemistry, Kongunadu Arts and Science College, Coimbatore, Tamil Nadu, India

Indira A Jayraaj
Department of Biochemistry, Kongunadu Arts and Science College, Coimbatore, Tamil Nadu, India

Correspondence
R Beena
Department of Biochemistry, Kongunadu Arts and Science College, Coimbatore, Tamil Nadu, India

Evaluation of insecticides against shoot and fruit borer *Leucinodes orbonalis* on brinjal at Tamil Nadu

R Beena, V Selvi and Indira A Jayraaj

Abstract
The roving survey was undertaken in major brinjal growing areas of Tamil Nadu *viz*., Coimbatore, Erode, Dindigul, Madurai and Thirunelveli to study the insecticide use pattern to control brinjal shoot and fruit borer, *L. orbonalis* revealed that, 18 different insecticides were frequently used to manage the target pest. The average number of spraying in one season was maximum in Dindigul (12 to 15) followed by Coimbatore (10 to 12), Thirunelveli (8 to 10), Erode (8 to 10) and Madurai (7 to 9). Usage of power sprayer maximum in all the five locations. Based on the survey result, eight insecticides *viz.*, chlorpyriphos, dimethoate, quinalphos, thiacloprid, emamectin benzoate, flubendiamide, thiodicarb and lambda-cyhalothrin were identified as prominently used insecticides to manage *L. orbonalis* in all locations, which were evaluated for its bioefficacy against target pest in the field condition. After two rounds of spray, the significant shoot damage reduction was observed in plots treated with thiacloprid 21.7 SC at 180 g a.i. ha^{-1} (95.47%) and flubendiamide 480 SC at 48 g a.i. ha^{-1} (92.00%) followed by lambda-cyhalothrin 5 EC at 15 g a.i. ha^{-1} (87.78%), emamectin benzoate 5 SG @ 10 g a.i. ha^{-1} (87.23%) and thiodicarb 75 WP at 750 g a.i. ha^{-1} (86.76%) in the first trial conducted at Thondamuthur during June to August 2016. Same trend was observed in the second field trial conducted at semmedu, during July to September 2016. In both the trials untreated check recorded the highest per cent shoot damage in all the days of observation. In terms of fruit damage, the plots treated with thiacloprid 21.7 SC at 180 g a.i. ha^{-1} received the highest per cent reduction over control followed by flubendiamide 480 SC at 48 g a.i. ha^{-1} lambda-cyhalothrin 5 EC at 15 g a.i. ha^{-1}, emamectin benzoate 5 SG @ 10 g a.i. ha^{-1} and thiodicarb 75 WP at 750 g a.i. ha^{-1} which were on par with each other in both trials.

Keywords: Brinjal, insecticide, bioefficacy, *L. orbonalis,* thiacloprid, flubendiamide

Introduction
Brinjal, *Solanum melongena* Linnaeus (Family: Solanaceae) has been cultivated in our country since ages and is the native of India. Brinjal is the only member of the Nightshade family to originate in the Eastern Hemisphere. According to the 2013 FAO Production Yearbook, the world eggplant production area was 1.871 million ha, and the total production was 49.50 million tonnes (FAO, 2015) [10]. In India eggplant was grown in an area of 6.8 lakh ha with the production of 11.89 million metric tonnes, while in Tamil Nadu the area is 7,189 ha and the productivity 13.08 tonnes (FAO, 2015) [10]. It is an annual crop and grown in all parts of India, except at higher altitudes (Chadha, 1993) [6]. Outside India, eggplant is especially important in South Asia (Bangladesh, Nepal and Sri Lanka) and this region accounts for almost 50 per cent of world’s area under brinjal cultivation.
The crop is one of the widely grown commercial vegetable crops in Tamil Nadu being highly productive finds its place as poor man’s crop. Such an economically important commercial crop is reported variedly to be infested by 142 species of insects, 4 species of mites and 3 species of nematodes (Sohi, 1966) [29], 26 pests (Vevai, 1970) [33], 23 species of insects and 19 diseases (Gowda and Veeresh, 1984) [12], 50 insect pests (Nair, 1995) [18], more than 36 pests (Regupathy *et al*., 1997) [24] from the time of its planting to harvest. Rizvi (1996) [25] highlighted nine major pests, mites and nematodes causing economic losses in brinjal.
Among them, the Internationally, known as eggplant fruit and shoot borer (EFSB) *Leucinodes orbonalis* (Guenee) (Pyraustidae: Lepidoptera) is one of the major constraints in all Asia (Butani and Jotwani, 1984; Chattopadhyay, 1987; Tewari and Sandana, 1987; AVRDC, 1995; Rashid *et al*., 2008) [5, 7, 31, 4, 23] contributing up to 80% loss in marketable yield (Ali *et al*., 1994; Raju *et al*., 2007; Onekutu *et al*., 2013) [2, 22, 19].

It is considered to be the most serious pest of brinjal in all parts of India (Isahaque and Chaudhuri, 1984) [14].

Currently farmers rely exclusively on the application of pesticides to control *L. orbonalis*, produce blemish-free brinjal fruits and get maximum yield from times it becomes very difficult to manage the pest. Chemical insecticides are used as the frontline defence sources against these insect pests and brinjal growers in India depend heavily on synthetic pesticides to combat pests and consume about 46 per cent of the total insecticides used in the country against vegetables (Anonymous, 2007) [3]. Most of the insecticides used on agricultural crops belong to a limited number of chemically different classes. Of them, the most important organic insecticides used against these pests of brinjal belong to organophosphates, carbamates and synthetic pyrethroids (Sidhu and Dhawan, 1977) [28]. In the recent past, synthetic pyrethroids have been extensively used for the control *L. orbonalis* in brinjal. Hence Considering the above perspective the present study has been undertaken to assess the insecticide usage pattern in brinjal against *L. orbonalis* and evaluate the bioefficacy of major insecticides against brinjal shoot and fruit borer.

Materials and method

Survey on pesticide usage pattern for brinjal shoot and fruit borer

A detailed survey on pesticide usage pattern in brinjal to control brinjal shoot and fruit borer, *L.orbonalis* was undertaken from brinjal growing farmers of Coimbatore, Erode, Dindigul, Madurai and Thirunelveli Districts of Tamil Nadu. Locations were selected considering the extent of cultivation of brinjal. The information on pesticide use pattern was gathered from 25 progressive farmers from each selected locations. An interview schedule was prepared based on the objectives of the present study and used for the collection of data by interviewing the individual farmer. The data on the educational status of farmer, size of holding, cropping pattern, pesticide use pattern for brinjal shoot and fruit borer and application technique were collected during March to May 2016. The objectives and scope of the study were first explained to the farmer for their fair cooperation. Even though the farmers of the study area did not maintain any records, they were able to furnish necessary information by memory recall and virtue of their experience. Information on sale of pesticides against brinjal shoot and fruit borer was also collected from the selected input dealers of study area.

Evaluation of bioefficacy of insecticides against brinjal shoot and fruit borer

Two field trials were conducted one each at Thondamuthur (Experiment I) and Semmedu (Experiment II), Coimbatore district in randomized block design (RBD). The first trial was conducted from June to August 2016, second from July to September 2016 using brinjal variety CO 2 to evaluate the bioefficacy of insecticides against shoot and fruit borer in brinjal. The crop was maintained well by adapting standard agronomic practices as per the recommendations of Tamil Nadu Agricultural University. Major insecticides used against brinjal shoot and fruit borer by the brinjal growing farmers and their dosages were, T_1 - Chlorpyriphos 20 EC @ 200 g a.i ha^{-1}, T_2 - Dimethoate 30 EC @ 300 g a.i ha^{-1}, T_3 - Quinalphos 25 EC @ 375 g a.i ha^{-1}, T_4 - Thiacloprid 21.7 SC @ 180 g a.i ha^{-1}, T_5 - Emamectin benzoate 5 SG @ 10 g a.i ha^{-1}, T_6 - Flubendiamide 480 SC @ 48 g a.i ha^{-1}, T_7 - Thiodicarb 75 WP @ 750 g a.i ha^{-1}, T_8 - Lambda cyhalothrin 5 EC @ 25 g a.i ha^{-1}, T_9 - Untreated control.

The observations on the damage of *L.orbonalis* on shoots and fruits were recorded on ten randomly tagged plants per plot before insecticide application and at 7 and 14 days after spraying. The shoot damage was assessed base on the bore holes / dried shoots on the plants. The fruit damage was assessed based on bore holes found on the fruit. The total number of shoots and infested shoots / fruits and infested fruits in ten randomly selected plants per plot were counted and the per cent shoot / fruit damage were calculated.

Results and discussion

Survey on insecticide use pattern

The need for properly managed, yet intensive agriculture, achieving, higher yields, is inevitable. This effort will require crop protection on a more intensive scale using agro chemicals. Agrochemicals have an important role in ensuring adequate food supply and better health for growing population. Synthetic insecticides have been the most powerful weapon for combating the menace of agricultural pests during the 21^{st} century. The survey was conducted with 125 farmers on insecticide use pattern on brinjal growing areas of Tamil Nadu *viz*., Coimbatore, Erode, Dindigul, Madurai and Thirunelveliduring March to May 2016 are presented in Table 1. During the survey, data were collected on number of sprays, method of spraying, insecticide used and frequency of spraying. The average number of spraying in one season on brinjal was maximum in Dindigul (12 to 15), Coimbatore (10 to 12), Thirunelveli (8 to 10), Erode (8 to 10) and Madurai (7 to 9). During the survey, it was found that power sprayer usage was maximum to spray insecticides in brinjal in all the five locations *viz*., Coimbatore (88%), Erode (76%), Dindigul (100%), Madurai (80%) and Thirunelveli (84%). Compared to power sprayer hand sprayer usage was very low and it was 12, 24, 0.0, 20 and 16 per cent in Coimbatore, Erode, Dindigul, Madurai and Thirunelveli, respectively.

Survey conducted among 25 farmers each in Coimbatore, Erode, Dindigul, Madurai and Thirunelveli found that totally eighteen insecticides *viz*., chlorpyriphos, dimethoate, quinalphos, thiacloprid, emamectin benzoate, flubendiamide, thiodicarb, lambda-cyhalothrin, triazophos, ethion, spinosad, chlorantraniliprole, fipronil, fenvalerate, indoxacarb, profenofos, carbaryl and cypermethrin were used by different farmers for brinjal shoot and fruit borer management (Table 1). Fenvalerate was not used in erode and cypermethrin were not used in Erode and Dindigul.

The overall usage of insecticide on brinjal in Coimbatore was in the descending order, chlorpyriphos (100%) = quinalphos (100%) = thiacloprid (100%) > thiodicarb (96%) > flubendiamide (84%) = fipronil (84%) > dimethoate (80%) = emamectin benzoate (80%) > chlorantraniliprole (72%) > triazophos (68%) = profenofos (68%) > lambda-cyhalothrin (64%) > spinosad (28%) = indoxacarb (28%) > carbaryl (16%) > ethion (8%) = fenvalerate (8%) > cypermethrin (4%). In Erode, maximum insecticide used wasquinalphos (100%) and minimum was carbaryl (36%). While that in Erode the usage of insecticides with descending order was quinalphos (100%) > chlorpyriphos (96%) = triazophos (96%) > thiodicarb (88%) > thiacloprid (84%) > dimethoate (80%) > flubendiamide (76%) = lambda-cyhalothrin (76%) = fipronil (76%) = profenofos (76%) > emamectin benzoate (68%) > spinosad (56%) = chlorantraniliprole (56%) > indoxacarb (48%) > ethion (44%) > carbaryl (36%). In the case of

Dindigul area, the usage of insecticides with declining order was thiacloprid (100%) > quinalphos (92%) = emamectin benzoate (92%) = fipronil (92%) > chlorantraniliprole (88%) = chlorpyriphos (88%) = flubendiamide (88%) > triazophos (84%) > thiodicarb (80%) > lambda-cyhalothrin (76%) > dimethoate (72%) = ethion (72%) = indoxacarb (72%) > profenofos (64%) > spinosad (52%)> carbaryl (28%)> fenvalerate (16%) (Table 1).

In Madurai, maximum insecticide used was quinalphos(100%) and minimum was fenvalerate (8%).The usage of insecticide in Madurai is given in the descending order, quinalphos (100%) > profenofos (96%) > triazophos (92%) > dimethoate (88%) = lambda-cyhalothrin (88%) > chlorpyriphos (84%) > emamectin benzoate (80%) = fipronil (80%) > thiacloprid (76%) > spinosad (72%) = chlorantraniliprole (72%) > flubendiamide (68%) = thiodicarb (68%) > ethion (44%) > indoxacarb (32%) = carbaryl (32%) > cypermethrin (28%) > fenvalerate (8%). In the case of Thirunelveli area, the usage of insecticides with declining order was, chlorpyriphos (100%) > quinalphos (96%) > thiacloprid (92%) > thiodicarb (88%) > triazophos (80%) > dimethoate (76%) > fipronil (72%) > lambda-cyhalothrin (68%) = ethion (68%) > flubendiamide (64%) = profenofos (64%) > emamectin benzoate (56%) > spinosad (48%) = chlorantraniliprole (48%) > carbaryl (40%) > indoxacarb (36%) > cypermethrin (20%) > fenvalerate (16%) (Table 1).

The survey revealed that maximum of 96 per cent farmers in Dindigul used insecticide mixtures to manage brinjal shoot and fruit borer followed by Thirunelveli (88%), Coimbatore(80%), Erode (76%) and Madurai (72%).With regard to frequency of spraying 3-7 days spraying interval was maximum in Dindigul (100%), Coimbatore (92%), Erode (72%), Thirunelveli (68%) andMadurai (60%). Whereas, 8-14 days spraying interval was maximum in Madurai (40%) (Table 1). Eight insecticides *viz.*, chlorpyriphos, dimethoate, quinalphos, thiacloprid, emamectin benzoate, flubendiamide, thiodicarb and lambda-cyhalothrin were identified as prominent insecticides used to manage brinjal shoot and fruit borer in all locations by cumulating the overall usage of insecticide in the individual locations (Fig. 1).

India in the past three decades has shown good advancement in the field of agrochemicals. Agrochemical research, in the recent years had advanced tremendously in discovering very active and safe chemicals and also in integrating their use with those from nature. The rapid advancement in the last three decades resulting from the synthesis of new insecticide chemicals, manufacture, formulation, mixtures and application have brought revolutionary changes in farm practices and farmers preferences to choose the molecules of their choice. Therefore, an increase in the usage of newer insecticide molecules, botanicals, pyrethroids and ready-mix combination products was observed.

Evaluation of bioefficacy of insecticides against brinjal shoot and fruit bore

Field experiment I (June to August 2016)

The pre-treatment observation on per cent shoot damage varied between 8.41 to 9.52 per cent. At 7 days after first spray thiacloprid 21.7 SC at 180 g a.i. ha^{-1} significantly reduced shoot damage and recorded 6.38 per cent. This was followed by flubendiamide 480 SC at 48 g a.i. ha^{-1} (6.81%) and found to be on par with thiacloprid 21.7 SC at 180 g a.i. ha^{-1}. Emamectin benzoate 5 SG @ 10 g a.i. ha^{-1} and lambda-cyhalothrin 5 EC at 15 g a.i. ha^{-1} also exerted shoot damage reduction as 7.45 and 7.42 per cent, respectively and were statistically on par. Other treatments *viz*., thiodicarb 75 WP at 750 g a.i. ha^{-1}, chlorpyriphos 20 EC at 200 g a.i. ha^{-1}, quinalphos 25 EC at 250 g a.i. ha^{-1} and dimethoate 30 EC at 200 g a.i. ha^{-1} were recorded 7.52, 7.97, 8.02 and 8.57 per cent shoot damage and found to be on par with each other. Similar trend was observed at 14 DAS. The highest reduction was observed in plots treated with thiacloprid 21.7 SC at 180 g a.i. ha^{-1} (5.25%) and flubendiamide 480 SC at 48 g a.i. ha^{-1} (5.73%) (Table 2).After second round of spray also thiacloprid 21.7 SC at 180 g a.i. ha^{-1} and flubendiamide 480 SC at 48 g a.i. ha^{-1}recorded lowest per cent shoot damage of 1.15 and 1.61 per cent, respectivelyat 7 DAS. Whereas, thiacloprid 21.7 SC at 180 g a.i. ha^{-1} and flubendiamide 480 SC at 48 g a.i. ha^{-1} recorded shoot damage of nil and only 0.42 per cent, respectively at 14 DAS. In terms of per cent reduction over control, the plots treated with thiacloprid 21.7 SC at 180 g a.i. ha^{-1} received the highest per cent reduction over control (95.47%) followed by flubendiamide 480 SC at 48 g a.i. ha^{-1} (92.00%). Untreated check recorded the highest per cent shoot damage in all the days of observation.

Incidence of fruit damage was recorded at 7 days interval. The pre-treatment per cent fruit damage ranged from 15.13 to 16.67 per cent. At 7 Days after first spraying, per cent fruit damage was minimum in the plots treated with thiacloprid 21.7 SC at 180 g a.i. ha^{-1} (7.09%) which was on par with flubendiamide 480 SC at 48 g a.i. ha-1 (7.39%). Lambda-cyhalothrin 5 EC at 15 g a.i. ha-1(8.21%) was on par with emamectin benzoate 5 SG @ 10 g a.i. ha-1 (8.35%) and thiodicarb 75 WP at 750 g a.i. ha-1(8.41%) at 7 DAS (Table 6). Other treatments viz., chlorpyriphos 20 EC at 200 g a.i. ha-1 (9.18%) followed by quinalphos 25 EC at 250 g a.i. ha-1 (9.27%) and dimethoate 30 EC at 200 g a.i. ha-1(9.78%) was on par with each other. At 14 DAS thiacloprid 21.7 SC at 180 g a.i. ha-1 was found effective and recorded the lowest fruit damage 2.17 per cent which was followed by flubendiamide 480 SC at 48 g a.i. ha-1(3.20%). Lambda-cyhalothrin 5 EC at 15 g a.i. ha-1 recorded 3.87 per cent fruit damage and this treatment was on par with emamectin benzoate 5 SG at 10 g a.i. ha-1 (4.00%) and thiodicarb 75 WP at 750 g a.i. ha-1 (4.12%) (Table 3).

In terms of per cent reduction over control, the plots treated with thiacloprid 21.7 SC at 180 g a.i. ha-1 received the highest per cent reduction over control (70.03%) followed by flubendiamide 480 SC at 48 g a.i. ha-1 (65.73%) (Table 6).After second round of spray also thiacloprid 21.7 SC at 180 g a.i. ha-1 and flubendiamide 480 SC at 48 g a.i. ha-1 recorded lowest per cent fruit damage of 0.83 and 1.69 per cent, respectively, followed by lambda-cyhalothrin 5 EC at 15 g a.i. ha-1 (2.61%), emamectin benzoate 5 SG @ 10 g a.i. ha-1 (2.69%) and thiodicarb 75 WP at 750 g a.i. ha-1 (2.72%) which were on par with each other at 7 DAS. The same trend was noticed at 14 DAS. In terms of per cent reduction over control, the plots treated with thiacloprid 21.7 SC at 180 g a.i. ha-1 received the highest per cent reduction over control (95.60%) followed by flubendiamide 480 SC at 48 g a.i. ha-1 (90.44%). Untreated check recorded the highest per cent fruit damage in all the days of observation (Table 3).

Field experiment II (Location: Semmedu during July to September 2016)

The pre-treatment observation on per cent shoot damage varied between 6.49 to 7.78 per cent. At 7 days after first spray thiacloprid 21.7 SC at 180 g a.i. ha^{-1} significantly reduced shoot damage and recorded 3.89 per cent (Table 4). This was followed by flubendiamide 480 SC at 48 g a.i. ha^{-1}

(4.42%). Lambda-cyhalothrin 5 EC at 15 g a.i. ha^{-1}, emamectin benzoate 5 SG @ 10 g a.i. ha^{-1} and thiodicarb 75 WP at 750 g a.i. ha^{-1}also exerted shoot damage reduction as 4.97, 5.00 and 5.07 per cent, respectively and were statistically on par. Chlorpyriphos 20 EC at 200 g a.i. ha^{-1} and quinalphos 25 EC at 250 g a.i. ha^{-1} were found to be on par with each other and recorded 5.59 and 5.61 per cent shoot damage, respectively. Similar trend was observed at 14 DAS. The highest reduction was observed in plots treated with thiacloprid 21.7 SC at 180 g a.i. ha^{-1} (3.03%) and flubendiamide 480 SC at 48 g a.i. ha^{-1} (3.67%).After second round of spray also thiacloprid 21.7 SC at 180 g a.i. ha^{-1} and flubendiamide 480 SC at 48 g a.i. ha^{-1}recorded lowest per cent shoot damage of 1.44 and 2.00 per cent, respectivelyat 7 DAS. Whereas, thiacloprid 21.7 SC at 180 g a.i. ha^{-1} and flubendiamide 480 SC at 48 g a.i. ha^{-1} recorded shoot damage of 0.21 and only 0.49 per cent, respectively at 14 DAS. In terms of per cent reduction over control, the plots treated with thiacloprid 21.7 SC at 180 g a.i. ha^{-1} received the highest per cent reduction over control (93.43%) followed by flubendiamide 480 SC at 48 g a.i. ha^{-1}(90.08%). Untreated check recorded the highest per cent shoot damage in all the days of observation (Table 4).

The pretreatment per cent fruit damage ranged from 12.67 to 13.78 per cent. At 7 Days after first spraying, per cent fruit damage was minimum in the plots treated with thiacloprid 21.7 SC at 180 g a.i. ha^{-1}(8.34%) followed by flubendiamide 480 SC at 48 g a.i. ha^{-1} (8.97%). Lambda-cyhalothrin 5 EC at 15 g a.i. ha^{-1}(9.83%) was on par with emamectin benzoate 5 SG @ 10 g a.i. ha^{-1} (9.90%) and thiodicarb 75 WP at 750 g a.i. ha^{-1}(10.01%). The other treatments *viz.*,chlorpyriphos 20 EC at 200 g a.i. ha^{-1} (10.85) and quinalphos 25 EC at 250 g a.i. ha^{-1} (10.94%) which were on par with each other. At 14 DAS, thiacloprid 21.7 SC at 180 g a.i. ha^{-1} was found effective and recorded the lowest fruit damage 6.51 per cent which was on par with flubendiamide 480 SC at 48 g a.i. ha^{-1}(6.29%). Lambda cyhalothrin 5 EC at 15 g a.i. ha^{-1} recorded 7.12 per cent fruit damage and this treatment was on par with emamectin benzoate 5 SG at 10 g a.i. ha^{-1} (7.15%) and thiodicarb 75 WP at 750 g a.i. ha^{-1} (7.21%) (Table 5).After second round of spray also thiacloprid 21.7 SC at 180 g a.i. ha^{-1} and flubendiamide 480 SC at 48 g a.i. ha^{-1}recorded lowest per cent fruit damage of 2.64 and 3.11 per cent, respectively, followed by lambda-cyhalothrin 5 EC at 15 g a.i. ha^{-1}(3.86%), emamectin benzoate 5 SG @ 10 g a.i. ha^{-1} (3.91%) and thiodicarb 75 WP at 750 g a.i. ha^{-1} (4.02%)which were on par with each other at 7 DAS. The same trend was noticed at 14 DAS. In terms of per cent reduction over control, the plots treated with thiacloprid 21.7 SC at 180 g a.i. ha^{-1} received the highest per cent reduction over control (86.66%) followed by flubendiamide 480 SC at 48 g a.i. ha^{-1} (83.34%). Untreated check recorded the highest per cent shoot damage in all the days of observation (Table 5).

Present findings is in accordance with Stanley *et al., (*2007) [30], who reported that emamectin benzoate 5 SG @ 7.5 g a.i. ha^{-1} was also effective against brinjal shoot and fruit borer,*L. orbonalis*. Prasad kumar and Devappa (2006) reported that emamectin benzoate SG at 200 g ha^{-1} was effective against cabbage diamond back moth and brinjal shoot and fruit borer. Thiacloprid was a novel and active chloronicotinyl insecticide with broad spectrum efficacy against sucking and biting insects at 48-180 g a.i. ha^{-1} depending on crop and pest. Five years of field studies in Germany have revealed the excellent control of important pests in fruit, vegetables and potatoes. Besides aphids and whiteflies it is also active against various species of beetles and lepidoptera, such as leaf miners, codling moth and oriental fruit moth and showed good plant compatibility in all relevant crops (Elbert *et al*., 2002) [9]. Saour (2008) [26] reported that thiacloprid was effective in reducing potato tuber moth larval survival on potato seedlings or adult emergence from potatoes, exhibiting activity for at least 14 days after application.

Patra *et al.* (2009) [20] evaluated insecticides against brinjal shoot and fruit borer, in the field during *kharif*, 2006. Emamectin benzoate 5 SG, lufenuron 10EC, spinosad 2.5 SC, indoxacarb 14.5 SC and methoxyfenozide 24 SC when Sprayed at 60, 75, and 90 days after transplanting all insecticidal treatments were significantly effective in reducing shoot and fruit borer infestation resulting in increasing fruit yield over the untreated control. Jagginavar *et al*. (2009) [15] studied bioefficacy of different insecticides against brinjal shoot and fruit borer, *L. orbonalis.* Results indicated that flubendiamide 480 SC @ 90 and 72 g a.i.ha^{-1} were significantly superior over other treatments and on par with each other in recording less shoot damage (11.43 and 16.21 per cent) at 7 days after first spray. Latif *et al*. (2010) [16] studied the bioefficacy of different insecticides against brinjal shoot and fruit borer. In field trials, flubendiamide at 0.5 g l^{-1} reduced more than 80 per cent shoot and fruit infestation in winter, and 80 per cent shoot and 70 per cent fruit infestation in summer over control.

Hanpur and Nandihali (2004) [13] evaluated the efficacy of certain insecticides and botanicals against potato shoot borer, *L. orbonalis*. Lowest shoot infestation was recorded in thiodicarb (23.30 per cent) followed by deltamethrin (28.65 per cent) and lambda-cyhalothrin (29.54 per cent). Chlorpyriphos treatment recorded 30.46 per cent shoot infestation which was at par with profenophos (32.49 per cent) and endosulfan (33.35 per cent). Tohnishi *et al*. (2005) [32] reported that flubendiamide showed extremely strong insecticidal activity especially against lepidopteran pests including resistant strains. Flubendiamide has novel mode of action, because the insecticidal symptoms accompanied by a discriminative contraction of larval body distinguished from those of commercial insecticides. Flubendiamide is expected to be a suitable agent for controlling lepidopteran insects as part of the insect resistance management and integrated pest management programmes. Misra (2008) [17] evaluated two new insecticides, *viz.*, rynaxypyr 20 SC and flubendiamide 480 SC in the field against brinjal shoot and fruit borer, *L. orbonalis* during winter, 2007 and summer, 2008. Results revealed that flubendiamide 480 SC was highly effective against *L. orbonalis.*

Rajavel *et al.* (1989) [21] reported that spray of lambda-cyhalothrin (31.5 to 50.0ppm) and deltamethrin (20.0 ppm) provided complete control of *L. orbonalis*, which is contrary to the present findings. Shah *et al*. (2012) evaluated bio-efficacy of insecticides against brinjal shoot and fruit borer, *L. orbonalis* on brinjal crop and reported that spinosad 45 SC @ 0.0135 per cent and thiodicarb 75 @ 0.075per cent were effective against brinjal shoot and fruit borer. Aiswariya (2010) [1] reported that all the emamectin benzoate treatments were comparatively less toxic to spiders. Emamectin benzoate 5 WSG at 9 g a.i. ha^{-1} recorded a mean of 4.94 and 6.05 spiders per 10 plants after first and second round of application, respectively. At higher doses, there was a slight, but non-significant reduction in spider population. Cole *et al.* (1997) [8] observed that lambda-cyhalothrin recorded little impact on ground spiders. Maleque *et al.* (1999) reported that cypermethrin applied at weekly intervals caused population reduction of ladybird beetles and spiders in brinjal ecosystem. Srinivasan and Sundarababu (2000) found that phosphamidon 40 SL at 300 g a.i.ha^{-1} recorded lower levels of toxicity to spiders in brinjal ecosystem.

Govindan *et al.* (2012) [11] reported that higher dose of emamectin benzoate 15 g a.i.ha^{-1} recorded a mean population of 2.67 - 3.93 spiders per 10 plants when compared to lower doses of emamectin benzoate 5 SG at 9 and 11 g a.i. ha^{-1} which recorded a mean of 3.35 - 6.66 and 3.35 spiders per 10 plants at the end of second experiment, respectively. Jyoti and Goud (2008) reported that emamectin benzoate 5 SG was safe to coccinellids, chrysopids and spiders in brinjal ecosystem. Yogesh Patel *et al*. (2009) [34] recorded minimum reduction in population of coccinellids, green lacewings, and chrysopids over control, in plots treated with emamectin benzoate at 8 g a.i.ha^{-1} followed by emamectin benzoate at 9.8 g a.i. ha^{-1}, spinosad45 SC at 75 g a.i.ha^{-1} and spinosad 45 SC at 100 g a.i.ha^{-1}. Sheeba jasmine and Kuttalam (2011) [27] suggested that emamectin benzoate 5SG and1.9 EC was found to be safer to coccinellids at different concentrations tested.

Table 1: Survey on pesticide use pattern on brinjal

Particulars		**Locations**				
		Coimbatore	**Erode**	**Dindugal**	**Madurai**	**Thirunelveli**
Number of spraying		10 - 12	8 - 10	12 - 15	7 - 9	8 - 10
Sprayer used (Percentage)	Power	22 (88)	19 (76)	25 (100)	20 (80)	21 (84)
	Hand	3 (12)	6 (24)	0	5 (20)	4 (16)
Insecticides used (Percentage)	Chlorpyriphos	25 (100)	24 (96)	22 (88)	21 (84)	25 (100)
	Dimethoate	20 (80)	20 (80)	18 (72)	22 (88)	19 (76)
	Quinalphos	25 (100)	25 (100)	23 (92)	25 (100)	24 (96)
	Thiacloprid	25 (100)	21 (84)	25 (100)	19 (76)	23 (92)
	Emamectin benzoate	20 (80)	17 (68)	23 (92)	20 (80)	14 (56)
	Flubendiamide	21 (84)	19 (76)	22 (88)	17 (68)	16 (64)
	Thiodicarb	24 (96)	22 (88)	20 (80)	17 (68)	22 (88)
	Lambda-cyhalothrin	16 (64)	19 (76)	19 (76)	22 (88)	17 (68)
	Triazophos	17 (68)	24 (96)	21 (84)	23 (92)	20 (80)
	Ethion	2 (8)	11 (44)	18 (72)	11 (44)	17 (68)
	Spinosad	7 (28)	14 (56)	13 (52)	18 (72)	12 (48)
	Chlorantraniliprole	18 (72)	14 (56)	22 (88)	18 (72)	12 (48)
	Fipronil	21 (84)	19 (76)	23 (92)	20 (80)	18 (72)
	Fenvalerate	2 (8)	0.0	4 (16)	2 (8)	4 (16)
	Indoxacarb	7 (28)	12 (48)	18 (72)	8 (32)	9 (36)
	Profenofos	17 (68)	19 (76)	16 (64)	24 (96)	16 (64)
	Carbaryl	4 (16)	9 (36)	7 (28)	8 (32)	10 (40)
	Cypermethrin	1 (4)	0	0	7 (28)	5 (20)
Insecticide mixture usage (%)		20 (80)	19 (76)	24 (96)	18 (72)	22 (88)
Frequency of spraying (in Days)	3 to 7	23 (92)	18 (72)	25 (100)	15 (60)	17 (68)
	8 to 14	2 (8)	7 (28)	0	10 (40)	8 (32)

Figures in the parenthesis are percentage values

Table 2: Effect of insecticides against shoot damage on brinjal

Location: Thondamuthur during June to August 2016									
Treatment	**PTC**	**First spray**				**Second spray**			
		7 DAS	**14 DAS**	**Mean**	**% ROC**	**7 DAS**	**14 DAS**	**Mean**	**% ROC**
Chlorpyriphos 20 EC @ 200 g a.i.ha^{-1}	8.91	7.97 (16.4)^{cd}	7.13 (15.49)^{c}	7.55	34.77	2.89 (9.79)^{d}	1.77 (8.67)^{d}	2.33	81.63
Dimethoate 30 EC @ 200 g a.i.ha^{-1}	8.89	8.57 (17.02)^{d}	7.69 (16.10)^{c}	8.13	29.76	3.51 (10.80)^{e}	2.54 (10.04)^{e}	3.03	76.15
Quinalphos 25 EC @ 250 g a.i.ha^{-1}	8.41	8.02 (16.45)^{cd}	7.15 (15.51)^{c}	7.59	34.47	2.93 (9.86)^{d}	1.89 (8.89)^{d}	2.41	81.00
Thiacloprid 21.7 SC @ 180 g a.i.ha^{-1}	9.45	6.38 (14.63)^{a}	5.25 (13.25)^{a}	5.82	49.76	1.15 (6.16)^{a}	0.00 (4.05)^{a}	0.58	95.47
Emamectin benzoate 5 SG @ 10 g a.i.ha^{-1}	9.52	7.45 (15.84)^{bc}	6.41 (14.67)^{b}	6.93	40.13	2.20 (8.53)^{c}	1.04 (7.13)^{c}	1.62	87.23
Flubendiamide 480 SC @ 48 g a.i.ha^{-1}	8.63	6.81 (15.13)^{ab}	5.73 (13.85)^{a}	6.27	45.83	1.61 (7.29)^{b}	0.42 (5.50)^{b}	1.02	92.00
Thiodicarb 75 WP @ 750 g a.i.ha^{-1}	9.46	7.52 (15.92)^{c}	6.49 (14.76)^{b}	7.01	39.48	2.21 (8.55)^{c}	1.15 (7.38)^{c}	1.68	86.76
Lambda-cyhalothrin 5 EC @ 15 g a.i.ha^{-1}	8.69	7.42 (15.81)^{bc}	6.37 (14.62)^{b}	6.90	40.43	2.13 (8.39)^{c}	0.97 (6.96)^{c}	1.55	87.78
Untreated check	8.95	10.59 (18.99)^{e}	12.56 (20.76)^{d}	11.58	-	12.67 (20.85)^{f}	12.70 (21.30)^{f}	12.69	0.00

* Mean of three replications. PTC – Pretreatment count, ROC – Reduction over control; Figures in the parentheses are Arc sine transformed values; In a column means followed by a common letter are not significantly different by DMRT (P=0.05)

Table 3: Effect of insecticides against fruit damage on brinjal

Location: Thondamuthur during June to August 2016									
Treatment	**PTC**	**First spray**				**Second spray**			
		7 DAS	**14 DAS**	**Mean**	**% ROC**	**7 DAS**	**14 DAS**	**Mean**	**% ROC**
Chlorpyriphos 20 EC @ 200 g a.i.ha^{-1}	15.33	9.18 (17.64)^{cd}	4.99 (12.91)^{d}	7.09	54.14	3.55 (10.86)^{d}	3.32 (10.50)^{d}	3.44	78.40
Dimethoate 30 EC @ 200 g a.i.ha^{-1}	16.05	9.78 (18.22)^{d}	5.91 (14.07)^{e}	7.85	49.22	4.73 (12.56)^{e}	4.28 (11.94)^{e}	4.51	71.67
Quinalphos 25 EC @ 250 g a.i.ha^{-1}	15.76	9.27 (17.73)^{d}	5.06 (13.00)^{d}	7.17	53.62	3.67 (11.04)^{d}	3.41 (10.64)^{d}	3.54	77.74
Thiacloprid 21.7 SC @ 180 g a.i.ha^{-1}	15.28	7.09 (15.54)^{a}	2.17 (8.47)^{a}	4.63	70.03	0.83 (5.23)^{a}	0.57 (4.33)^{a}	0.70	95.60
Emamectin benzoate 5 SG @ 10 g a.i.ha^{-1}	16.67	8.35 (16.80)^{bc}	4.00 (11.54)^{c}	6.18	60.03	2.69 (9.44)^{c}	2.23 (8.59)^{c}	2.46	84.53
Flubendiamide 480 SC @ 48 g a.i.ha^{-1}	16.25	7.39 (15.77)^{a}	3.20 (10.30)^{b}	5.30	65.73	1.69 (7.47)^{b}	1.35 (6.67)^{b}	1.52	90.44
Thiodicarb 75 WP @ 750 g a.i.ha^{-1}	16.46	8.41 (16.86)^{bc}	4.12 (11.71)^{c}	6.27	59.45	2.72 (9.49)^{c}	2.39 (8.89)^{c}	2.56	83.93

Lambda-cyhalothrin 5 EC @ 15 g a.i.ha^{-1}	16.21	8.21 (16.65)^{b}	3.87 (11.35)^{c}	6.04	60.91	2.61 (9.30)^{c}	2.16 (8.45)^{c}	2.39	85.00
Untreated check	15.13	15.37 (23.08)^{e}	15.53 (23.21)^{f}	15.45	0.00	15.77 (23.40)^{f}	16.03 (23.60)^{f}	15.90	0.00

* Mean of three replications. PTC – Pretreatment count, ROC – Reduction over control; Figures in the parentheses are Arc sine transformed values; In a column means followed by a common letter are not significantly different by DMRT (P=0.05)

Table 4: Effect of insecticides against shoot damage on brinjal

Location: Semmedu during July to September 2016									
Treatment	**PTC**	**First spray**				**Second spray**			
		7 DAS	**14 DAS**	**Mean**	**% ROC**	**7 DAS**	**14 DAS**	**Mean**	**% ROC**
Chlorpyriphos 20 EC @ 200 g a.i.ha^{-1}	7.34	5.59 (13.68)^{d}	5.19 (13.17)^{d}	5.39	38.29	3.29 (10.45)^{d}	2.82 (10.50)^{d}	3.06	75.67
Dimethoate 30 EC @ 200 g a.i.ha^{-1}	7.78	6.17 (14.38)^{e}	5.95 (14.12)^{e}	6.06	30.62	3.91 (11.40)^{e}	3.69 (11.81)^{e}	3.80	69.73
Quinalphos 25 EC @ 250 g a.i.ha^{-1}	7.46	5.61 (13.70)^{d}	5.27 (13.27)^{d}	5.44	37.72	3.34 (10.53)^{d}	2.88 (10.59)^{d}	3.11	75.23
Thiacloprid 21.7 SC @ 180 g a.i.ha^{-1}	6.87	3.89 (11.38)^{a}	3.03 (10.02)^{a}	3.46	60.39	1.44 (6.89)^{a}	0.21 (4.83)^{a}	0.83	93.43
Emamectin benzoate 5 SG @ 10 g a.i.ha^{-1}	7.52	5.00 (12.92)^{c}	4.47 (12.21)^{c}	4.74	45.79	2.60 (9.28)^{c}	1.77 (8.67)^{c}	2.19	82.60
Flubendiamide 480 SC @ 48 g a.i.ha^{-1}	7.31	4.42 (12.14)^{b}	3.67 (11.04)^{b}	4.05	53.69	2.00 (8.13)^{b}	0.49 (5.71)^{b}	1.25	90.08
Thiodicarb 75 WP @ 750 g a.i.ha^{-1}	6.67	5.07 (13.01)^{c}	4.51 (12.26)^{c}	4.79	45.16	2.63 (9.33)^{c}	1.90 (8.91)^{c}	2.27	81.96
Lambda-cyhalothrin 5 EC @ 15 g a.i.ha^{-1}	6.83	4.97 (12.88)^{c}	4.38 (12.08)^{c}	4.68	46.48	2.64 (9.35)^{c}	1.65 (8.43)^{c}	2.15	82.92
Untreated check	6.49	7.91 (16.33)^{f}	9.56 (18.01)^{f}	8.74	0.00	11.37 (19.71)^{f}	13.74 (22.17)^{f}	12.56	0.00

* Mean of three replications. PTC – Pretreatment count, ROC – Reduction over control; Figures in the parentheses are Arc sine transformed values; In a column means followed by a common letter are not significantly different by DMRT (P=0.05)

Table 5: Effect of insecticides against fruit damage on brinjal

Location: Semmedu during July to September 2016									
Treatment	**PTC**	**First spray**				**Second spray**			
		7 DAS	**14 DAS**	**Mean**	**% ROC**	**7 DAS**	**14 DAS**	**Mean**	**% ROC**
Chlorpyriphos 20 EC @ 200 g a.i.ha^{-1}	13.46	10.85 (19.23)^{d}	8.13 (16.57)^{c}	9.49	27.47	4.89 (12.78)^{d}	3.21 (10.32)^{d}	4.05	69.74
Dimethoate 30 EC @ 200 g a.i.ha^{-1}	13.78	11.72 (20.02)^{e}	8.96 (17.42)^{d}	10.34	20.98	5.91 (14.07)^{e}	4.22 (11.85)^{e}	5.07	62.16
Quinalphos 25 EC @ 250 g a.i.ha^{-1}	13.24	10.94 (19.31)^{d}	8.17 (16.61)^{c}	9.56	26.98	4.97 (12.88)^{d}	3.25 (10.39)^{d}	4.11	69.29
Thiacloprid 21.7 SC @ 180 g a.i.ha^{-1}	12.81	8.34 (16.79)^{a}	6.51 (14.78)^{a}	7.43	43.26	2.64 (9.35)^{a}	0.93 (5.53)^{a}	1.79	86.66
Emamectin benzoate 5 SG @ 10 g a.i.ha^{-1}	12.67	9.90 (18.34)^{c}	7.15 (15.51)^{b}	8.53	34.85	3.91 (11.40)^{c}	2.26 (8.65)^{c}	3.09	76.95
Flubendiamide 480 SC @ 48 g a.i.ha^{-1}	13.59	8.97 (17.43)^{b}	6.29 (14.52)^{a}	7.63	41.69	3.11 (10.16)^{b}	1.35 (6.67)^{b}	2.23	83.34
Thiodicarb 75 WP @ 750 g a.i.ha^{-1}	12.93	10.01 (18.44)^{c}	7.21 (15.58)^{b}	8.61	34.20	4.02 (11.57)^{c}	2.31 (8.74)^{c}	3.17	76.35
Lambda-cyhalothrin 5 EC @ 15 g a.i.ha^{-1}	12.75	9.83 (18.27)^{c}	7.12 (15.48)^{b}	8.48	35.23	3.86 (11.33)^{c}	2.19 (8.51)^{c}	3.03	77.40
Untreated check	12.87	13.04 (21.17)^{f}	13.13 (21.24)^{e}	13.09	0.00	13.26 (21.35)^{f}	13.51 (21.57)^{f}	13.39	0.00

* Mean of three replications. PTC – Pretreatment count, ROC – Reduction over control; Figures in the parentheses are Arc sine transformed values; In a column means followed by a common letter are not significantly different by DMRT (P=0.05)

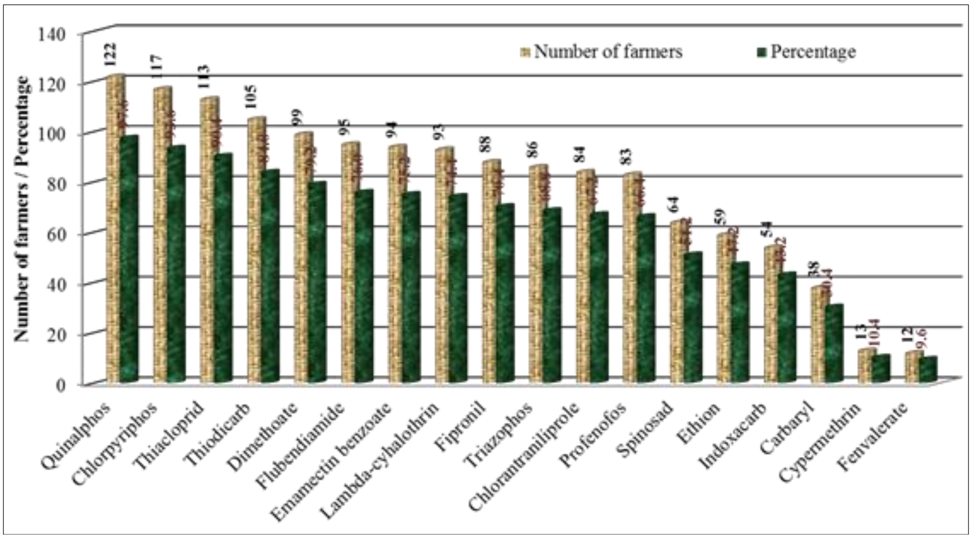

Fig 1: Insecticide usage pattern to control *L. orbonalis* in brinjal

References

1. Aiswariya KK. Bio efficacy, phytotoxicity and residues of emamectin benzoate 5WSG against bollworms of cotton and fruit borers of okra. Ph.D. (Ag) thesis, Tamil Nadu Agric. Univ., Coimbatore-3, India. 2010, 224p.
2. Ali MI. Circumstantial evidence supports insect resistance in Bangladesh. Resistance Pest Management. 1994; 6(1):5.
3. Anonymous. European Commission, Directorate General Health and Consumer Protection, SANCO/2007/3131 (Supersedes Document No. SANCO/10232/2006) - Method Validation and Quality Control Procedures for Pesticide Residues Analysis in Food and Feed, http://ec.europa.eu/food/plant/protection/resources/qualcontrol_en.pdf, [Accessed 31 October 2014]. 187-193. agrochemicals (ed. by MB Green, HM LeBaron & WK

Moberg) American Chemical Society, Washington, USA, 2007, 77-91.

4. AVRDC. AVRDC report 1994. Asian Vegetable Research and Development Centre, Shanhua, Taiwan, 1995, 520.
5. Butani DK, Jotwani MG. Insects in Vegetables. Periodical Expert Book Agency, New Delhi, India, 1984, 356p.
6. Chadha ML. Improvement of brinjal. In: Advances in Horticulture. Vegetable crops: Part I. Chadha, C.K.L. and G. Kallo (eds.). Malhotra Publishing House, New Delhi, India. 1993; 5:105-135.
7. Chattopadhyay P. Entomology, Pest Control and Crop protection. West Bengal State Board, Calcutta, India, 1987, 304.
8. Cole JF, Pilling ED, Boykin R, Ruberson JR. Effects of Karate insecticide on the beneficial arthropods in Bollgard cotton. In: Proc. Beltwide Cotton Conf., Jan. 6-10, New Orleans, LA, USA. 1997; 2:1118-1120.
9. Elbert A, Erdelen C, Kuhnhold J, Nauen R, Schmidt HW, Hattori Y. Thiacloprid, a novel neonicotinoid insecticide for foliar application. BCPC Conf. pests Dis., 2000, 21-26p.
10. FAO. (Food and Agriculture Organization). 2015. Faostat. http:// faostat.fao.org [accessed 15 June 2015].
11. Govindan K, Gunasekaran K, Kuttalam S. Field Evaluation of Emamectin Benzoate 5 SG against okra fruit borers. Madras Agric. J. 2012; 99 (7-9):597-600.
12. Gowda KS, Veeresh GK. Assessment of crop loss in brinjal (*Solanum melongena* L.) due to ash weevil *Myllocerus subfasciatus* Guerin. (Curculionidae: Coleoptera). J Soil Biol. Ecol. 1984; 4(1):41-52.
13. Hanpur RH, Nandihali BS. Bio-Efficacy of certain insecticides and botanicals against the potato shoot borer, *Leucinodes orbonalis* Guenee. Karnataka J Agri. Sci. 2004; 17(3):602-603.
14. Isahaque NMD, Chaudhuri RP. A new alternate host plant of brinjal shoot and fruit borer Leucinodes orbonalis Guene in Allam. J Res. Assam Agric. Univ. 1984; 4(1):83-85.
15. Jagginavar SB, Sunitha ND, Biradon AP. Bioefficacy of flubendiamide 480SC against brinjal fruit and shoot borer, *Leucindoes orbonalis* Guen. Karnataka Journal of Agricultural Sciences. 2009; 22(3):712-713.
16. Latif MA, Rahman MM, Alam MZ. Efficacy of nine insecticides against shoot and fruit borer, *Leucinodes orbonalis* Guenee (Lepidoptera: Pyralidae) in eggplant. J Pestic. Sci. 2010; 83:391-397.
17. Misra HP. New promising insecticides for the management of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee. Pest Manage. Hort. Ecosys. 2008; 14:140-147.
18. Nair MRGK. Insects and Mites of Crops in India. ICAR, New Delhi, India, 1995, 408p.
19. Onekutu A, Omoloye AA, Odebiyi JA. Biology of the eggfruit and shoot borer (EFSB), *Leucinodes orbonalis* Guenee (Crambidae) on the garden egg, *Solanum gilo* Raddi. Journal of Entomology. 2013; 10(3):156-162.
20. Patra S, Chatterjee ML, Mondal S, Samanta A. Field evaluation of some new insecticides against brinjal shoot and fruit borer, *L. orbonalis* (Guen). Pestic. Res. J. 2009; 21:58-60.
21. Rajavel DS, Gopalan M, Balasubramanian G. Evaluation of synthetic pyrethroids in the control of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. Madras Agric. J. 1989; 76:114-116.
22. Raju SVS, Bar UK, Shankar U, Kumar S. Scenario of infestation and management of eggplant shoot and fruit borer, *Leucinodes orbonalis* GUEN. India Resistant Pest Manage. Newsletter. 2007; 16:14-16.
23. Rashid MH, Mohiuddin M, Mannan MA. Survey and identification of major insect pest and pest management practices of brinjal during winter at Chittagong district. Int. J Sustain. Crop Prod. 2008; 3(2):27-32.
24. Regupathy A, Palanisamy S, Chandramohan N, Gunathilagaraj K. A guide on Crop Pests, Sooriya Publishers, Coimbatore 641012, 1997, 264.
25. Rizvi SMA. Management of insect pests of okra and brinjal. In: Plant Protection and Environment. Reddy, D.V.R., H.C. Sharma, T.B. Gour and B.J. Divakar (eds.). Plant Prot. Assoc. India, Hyderabad, India, 1996, 173-188.
26. Saour G. Effect of thiacloprid against the potato tuber moth *Phthorimaea operculella* Zeller (Lepidoptera: Gelechiidae). J Pest. Sci. 2008; 81:3. doi:10.1007/s10340-007-0188-3.
27. Sheeba Jasmine R, Kuttalam S. Emamectin benzoate 5SG and 1.9 EC: A safer insecticide to coccinellids of bhendi ecosystem. Madras Agric. J. 2011; 98(1-3):92-94.
28. Sidhu AS, Dhawan AK. Parasites of the cotton leaf roller and the effect of insecticides on their survival. Pesticides, Bombay. 1977; 11(11):28-29.
29. Sohi ML. Control of root knot nematode (Meloidogyne incognita) of plant with some granular nematicides. Curr. Res. Retr. 1966; 1(1):15-17.
30. Stanley J, Chandrasekaran S, Regupathy A. Evaluation of emamectin benzoate against brinjal fruit borer *Leucinodes orbonalis* (Guen.). Pestic. Res. J. 2007; 19(1):34-36.
31. Tewari GC, Sandana HR. Eriborusargenteopilosus (Caweras) a new parasite of *Leucinodes orbonalis* Guen. *Entomon.* 1987; 12(3):227-228.
32. Tohnishi M, Nakao HF, Sco T, Kodama AH, Tsubata K, Fujioka S *et al*. Fluebendiamide, a novel insecticide highly active against lepidopteran insect pests. Journal of Pesticides Science. 2005; 34:354-360.
33. Vevai EJ. Know your crop, its pest problems and control - 25 BRINJAL. Pesticides, 1970, 26-30.
34. Yogesh Patel H, Sharma B, Das SB. Emamectin benzoate 5% WSG: A safer insecticide for cotton bollwork complex management, CICR Newsletter. 2009; 25:34-37.